# THE HAVEN: FINDING ART,

THE WAY TO FIND any Hauen or place at leady the Latitude and volume.

Lately published in the commander of the and Latine tongues, by commander of the right honourable Count Mauritz of National high Admiral of the vnited Prouince Low countries, eniopping all Seamen and take charge of ships under his jurished chon, to make diligent observation, in all their voyages, according to the directions prescribed herein:

And now translated into English, for the common benefite of the Seamen of England,

G.B.R.N. and R.B.

1599

THE HAVEN THA DIMININALT. THE WAY TO BIT any Hauen or place arlea by the Latitude in Lougiandra. aceiv published in the Dutem, French, and Latine tongues, by commandement of the right bone weble Come Admin of Mafen third high Admiral of they weed Provinces of the Low connectes, enloyeing all Seamen chieff. take thatge of farpy vider his welldis ducustomake daligentoblerustis remit out, in all those vayages, acspecification of the directions preferibed herein: Andrian translitted into Ling if for the common benefits of the Seamen of England. Imprinted at London by G.B.R. N. and R.B.

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# TO THE RIGHT

Honorable Charles Earle of Notingham, Baron Howard of Effingham, knight of the noble Order of the Garter, Lordhigh Admiral of England, Ireland, Wales, &c., And her Maichies Lieutenant, and Captaine general ouer

Maichtics Lieutenant, and Captaine general ouer all her lubiects, lenied in the South parts of this Realme, &c.



Ight Honourable, being informed by my learned friend and most earnest and effe-Etuall furtherer of Nauigation for the common good of his countrey M. Richard Hackluit, poon the dedica-

Lorabout a yeere since, of the singular affection your Lor beareth towardes the advancement of knowledge and skill among our seamen in marine causes; so farre foorth that to the end they might be the more stirred vp and holpen this way, your Lor would not onely be a meane vnto her Maiestie for the establishing of an ordinary Lecture to be read for their instruction, but also rather then so good a purpose should fall to the ground would be at some charges your selfe for the bringing of it to effect: I conceived no small comfort vpon this report,

## THE EPISTLE

considering that now of late, the right honorable Count Maurice of Naffany, L. bigh Admirall of the onited Prouinces of the low countries bath Thewed himselfe wholly to be of your Lor. minde, thinking it a most principal point for the welfare of their estate to have their mariners now entring into long voyages to be better informed in matters cocerning their faculty, the beretofore they have bene. To which end he hath lately caused a certaine exbortatory intunction to be published, and hath also ginen commandement that the same should be dili= getly observed by all masters of ships and their com= panies within the lame Provinces. By observation wher of they may have a more certaine and compendious way, whereby they may guide themselves to come to any place they shall destre at sea, with a Streighter course and in shorter time then bath bin commonly accustomed: VV hich way is to be found by knowledge of the latitude and variation of the place wherto they purpose to go. For seeing one and the same place hath alwaies the same latitude and variation, whereof the one she weth what situation the place bath between North and South the other between East and VVest, it cannot be but that the master of the ship bringing himselfe to the latitude ana

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# DEDICATORIE

and variation of the place to which he purpofeth to go, must needs bring bimselfe to the same place also.
Considering therefore howe great profit might hereby redound to feamen if the variations of all places were truely known, the aid Count Mau rice bath ginen commandement to all what shall take charge of ships, that before they set forth, they should provide themselves meete instruments for that purpose that into what place soener they shall come, they may diligently fearch out the declination of the magneticall needle from the true North (which they comonly cal the variation of the Compasse) and that after their returne into their owne countrey they should give a true certificate of those observations to the rest of their collegues and com panies of the Admiralty, that by them they may be brought into some good order and method, and so be published for their common good. Defiring also as it may appeare to stirre up other nations to the same care and diligence in observing the variation, he bath caused the said miunction to be published, not only in his own native tongue, but in the French and Latine alforintending (as it may feeme hereby) to make not only it but also his honorable desire in furthering this observation commonly known to

cause

#### THEOEPISTLE

all (bristendome. Defiring therefore, according to the measure of my small abilitie, to be a furtherer of so good a purpose of so famous a per-Jonage Thave done mine indevour to make the Jame knowen to all English mariners, by publishing the forefaid Iniunction in their mother tongue nothing doubting, but as they have not bene inferiour to any nation, either for excellency of skill, or felicitie in performance of their most wonderfull Nauigations, and that principally in this most happy time of your Lor enioying your most honorable office of high Admiralty: So, if it might please your Lor to give them to understand that your Lor would be very loth that English mariners (whom I have knowen to have bad the skill, to finde out places at fea by the latitude to variation, after the fame maner that is prescribed in this booke, more then ten yeres fince) [bould now (either for too much sparingues in not preparing or for want of diligence in heedful ving meete instrumets for that purpose) cast themselves behinde the Netherlanders; there may affured hope be conceived, that they wil not only not come behind but farre exceed and go beyond them, or any other nation. And fo much the rather there is reason to induce vs to be of this opinion, because

#### DEDICATORIE

cause there bath bene a secret of the magneticall needle sirst renealed by our countriman M. Rob. Norman, where of other nations as yet seeme to be ignorant, I meane the falling of the North end of the needle touched with the loadstone under the horizon. Of which new found propertie if there shall be diligent and continual observation made, especially in long voyages, there may in all likelihood no lesse profit arise thereby then by the variation.

Considering therefore how greatly your Lor.anthority, yea inclination or beck onely mought preuaile to move the minds of all English mariners to the diligent beedfull, and continual observation of these so rare and wonderful properties of the magneticall needle, at all places whereforever they shall come, wherby so great profit may affuredly redound not onely to seamen, but even to the whole body of the Christian commonwealth: I was imboldened, recounting with my felfe your Lory exceeding clemencie conjoyned with fo high authority to bring before yourmost honorable presence this Dutch Pilot (as it were, for so I may not confitly call this booke ) whom since bis arrivall here I have onely taught to speake English that so be might be the more serviceable vnto your Lor, and to all English Seamen

E. 18veger

## THEO E BISTULED

seame in that he professeth which is to bring them to any place in the main Ocean, by a shorter course. then bath bene accustomed. VV berein because the renowmed Count Maurice bis mafter bath eine him so great credit as to comand him to be imploied by althoutake charge of flips under bis office of admirally, may it therfore pleafe your L. to affoord him the favour as to commend him to all English maisters to be thorowly examined by due trial of exact observatio in al places at sea, to the end that if he shall be found indeed to performe formuch as he promifeth wherof there is given exceeding great hope by proofe already made by some of our skilful lest English navigators) be may for ever after be receined with enterteinmet mortby fo notable ferrices Thus nothing doubting that this Dutch Pilot for highly commended by so worthy a personage, shall find such favourable acceptation at your Libands as in your Lar high wisedown to him duely appearais neth: Imofabumbly befeech the Lord of all Lords to increase your Lor, with all true honour in this life, and with endlesse bliffe in that life which shall last for ever 123. Augus 599 sound moder ( shood taught to heake Findish that so he might be the tina to all English

feitmen.

E.Wright.

# TO THE WORSHIP-

full M. Richard Poulter the Maister, and brotherhood of Trinitie house, and to all English Mariners and sea-men in generall that loue the pertection of their owne profession, health and happines.



Auing dedicated this litle Booke to the Right Hon. the Lord high Admirall of England, to whom the government of sea causes next under her Maiestie chiefly appertainesh (with whom also it hath found such fauourable acceptation as of so honorable a per-

sonage might be instly expected) I thought it meete in the next place to commend the same to your Wor. societie also, as to them who have best occasion in your so manifold nauigations to make most plentifull and sufficient triall thereof, and to whom it may affuredly doe most necessary and profitable service. But least you should stand in doubt of this my commendation, the Right Honourable Count Maurice Lord high Admirall of the wnited Proninces of the Low Countries, bath not only commended the same to all Masters of Ships and their companies (or brotherboods as we may call them) that are under his jurisdiction; but hath also commanded them to make diligent and continual observation in all their voyages, according to the directions prescribed herein. He also, as not content that the fruit which may spring hereof should be conteined within the narrow boundes and compasse of the Lowe Countries, bath caused this booke to be translated into the French

## TO THE SEA-MEN

French and Latine tongues: endeuouring as it may seeme bereby to make the same knowen to all nations in Christendome. Amongst whom as the Latine translatour M. Hugo de Groot bath chosen the Venctians for their excellencie in Nauigation (as he conceiueth) to whom he might especially dedicate this small Volume togither with his owne labour in translating the same: So I thought it meete to make choise of your worshipfull society, whom I take to be nothing at all inferiour to the Venetians either for excellencie of skill, or for whe and experience in that facultie: and to whom I may more suffly commend this little Booke, even almost with the same words which Hugo de Groot wieth to the Venetians as followeth.

Therefore that we may enter a little more deepely into the matter, Aristotle the wittiest of all philosophers and the most famous Lawyers doe witnesse that all arts were founde, out of the necessitie of mans nature, that what is wanting in one, might be supplied by that which is abounding in another: and that because every countrey yeeldeth not all things, there might be a mutual exchange of one thing for another by way of merchandife, But now because dinerse countries are very far distant each from other, that there can be no carriage of any waves or marchandise from the one to the other, either on beasts backs or in cartes: the art of Nauigation was therefore inuented, that the sea might supply the want of dry land. Tet surely skilfull nature hath done all this in vaine, if a certaine way bow to Sayle cannot in some fort be found, but that mariners must be constrained to make their voyages doubtfully not knowing what course to keepe. Therefore the

#### MOFENGLANDO

the ancient navigators (thinking not without cause that there was great affinitie betweene Astronomie and Nauigation directed all their courfe by the starres , the Sidonians by the lesser beare which is the certainer, the Grecians by the greater which is the clearer. But because neither star truely shewed the North part of the world, they were oftentimes deceined in their coniectures: and because the night is not alwayes so cleare that those starres may be seene, if the skie were at any time overcast they had no meanes wherby they might know which way they ought to guide themselves. Hereof it commeth that in ancient authors oftentimes, & in many places we fee the mariners complaining of the darknesse of the nights and that the greatest and most famous nauses have beene dispersed and discomfitted, by reason of the uncertaintie of thefe things.

But affuredly it seemeth to be so ordeined by nature, that all things should not be brought to light at one time; but that after a long continuance of times the certaintie of things should be knowen. There is a stone which for the exceeding great strength thereof is called Herculeus, that is the stone of Hercules, & becanse it draweth iron unto it, is by the Grecians called nonesm, comonly it is called by the name of him that first foundit, Magnes, that is the Magnete or Load stone. For it appearethout of Nicander and Plinie, that one Magnes found it sticking to a sharpe pointed piece of yron. After a great number of yeeres a new propertie of that stone was reneiled, that being rubbed open yron, or rather open steele, it would make the same point to the North. Therefore when by this marueilous pointing the mariners knew the North, B 2 and

: Neld

# TO THE SEA-MEN

and over against it the South, and making account by the elevation of the pole they learned also the latitude; then they had (as it was thought) means sufficient of infallible direction how to guide thefelues at all times. But neither did this ioy (as many times it commeth to paffe) continue long. For when they sayled from the East westwards, the Loadstone was found by little and little to decline from the North; which thing strooke no small doubtfulnesse and uncertaintie into the mariners mindes. Tet nowe at the length, by long observation of the declinations of the loadstone that have bene diligently sought out in diverse places and times, the matter is brought to that iffue, that they which are most skilfull in the Mathematicks, and amongst them the faid Count Maurice of Nassau, have supposed that this declination of the Loadstone happeneth not by chance, but is caused by some certaine reason in nature, that according to the varietie of places the pointing of the needle should also varie.

Wherefore the said Count Maurice sent this exhortatorie iniunction (for so Imay call this little booke written by his Mathematician Steumius) to them that take
charge of ships, that if these things were not found in all
points to be so as his observation importeth, they should do
so much as in them lay, that out of diverse experiments
some certaine reason and rule of the variation might be
gathered which if it may by diligent observation be obteined, then there shall not onely be a more certaine way to
knowe the course from place to place by the instrument
made to sinde the variation (of which way more shall be
spoken in the booke it selfe) but the longitude also, or rather the effect of the longitude shall be given by the variation;

#### MORENGLAND.

tion; which thing also shalbe showed more at large in the Treatife it selfe following. Because therefore it is certaine that this knowledge cannot otherwise be found but by the experiments of divers men compared togither, and that by divers observations a more easte may may be prepared for science ( which from the particulars ariseth op unto the univerfall) I thought good to prefent unto you this iniunction of the worthy Count Maurice, that if you (which are most expert in Nauigation) be of opinion that there may be so great profite of this matter as we (which thinke it to appertaine to the principal state of the comon-wealth) you might doe your best endenour unto what place foener you shall come ( saking with you needfull instruments for that purpose) to observe diligently the variation of the magneticall needle, that at length we may come so that certaintie, that they which take charge of Ships may know in their navigations to what latitude and to what variation (which shall ferue in stead of the longisude not yet found) they ought to bring themselves, that by this meanes they may affuredly finde what place focuer they will in the midst of the maine Ocean fea. And alshough this bee the end for which principally this Booke was made, not with standing we make no doubt that there may many more be found no lesse profitable then this; of which fort is that which wee of late have found, which may also be of very great profit unto us: To wit, that when any nauie ( for which cause our common-wealth hath observed exceeding creat renowne) is prepared against the enemie, a certaine place may be appointed in the midst of the fea, into which (if perchance too great a force should come upon them unlooked for ) all the ships after

#### TO THE SEAMEN

after a certaine time might affemble themselves. Whereto I may also adiopness third we of the variation, that is,
the reforming of many errors which must needes be in
the ordinarie sea-charts, because the coasts of all countries
and the courses from place to place, have beene set downe
in them by direction of the varying compasse, without abatemes or allowance answerable to the variation, wherof there must needes follow much deformitie and consusion in many parts of the chart, especially where the variation is great, as it is upon the coast of Newsoundland; where the variation being two whole points of the
compasse (as it is reported) there must needes be so much
error also in laying out all the sea coast of that country,
and in the courses of all places neere adiopning in the ordinarie sea charts. All which errors may be amended, if
the variations be suffit truely observed, and then abated
from, or allowed to the courses of all places, as needes shall
require.

But the variation cannot ferue to so great vse as othermise it might, except other errors also as well in the chart, as in other instruments and meanes of navigation he also avoyded. For the chart as it hath beene hitherto generally made with right lined rumbes and degrees of latitude every where equal, must needes be very erroneous, especially in the Northerne parts thereof, that although all the foresaid errors arising by the variation were conrected, yet for this cause onely you may be edecined one, two, yeathree whole points of the compasse, in the courses of many places: and in measuring the distance you may erre one halfe, yea three quarters and more sometimes, accounting the same to be twise, yea thrise greater then indeede

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#### OF ENGLAND.

indeede it is, especially in farre Northerly navigations.

If therefore these so notorious errors be not also amended,

the correction of the errors arising by the variation, can-

not be to so great purpose as otherwise it might.

Neither can that be so fully performed which in the Treatife following is chiefly intended (that is, to find any place at feaby the variation and latitude) except the meanes that have beene vied for finding the latitude be also amended. For in observing the heigth of the sunne and starres, with the small crosse-stanes which are most viuall for that purpose, there may be error of halfe a degree, and more sometimes by neglect of the parallax or eccentricity of the observers eye. The Regiments or Tables of declination of the sunne that have bene most commonly vied by English mariners doe erre oft times ten, eleven, or twelve minutes. The rule of allowances and abatements to be added to, or subtracted from the heigth of the pole-starre for finding the heigth of the pole (being grounded upon a false position, to wit, that the pole starre is three degrees and an halfe distant from the pole, when indeede it is almost 40 minutes lesse) must needes be falfe many times more then halfe a degree.

The declinations of the principall fixed starres at they are set downe in the bookes of Nauigation, that have bene heretofore published, are for the most part erroneous; many of them differing from trueth about halfe a degree, or some of them an whole degree, yea two whole degrees and more. All which imperfections of so excellent an art, I have since the time of my first employment at sea (now more then tenne yeeres since) by diligent search with no small labour discovered and amended, not onely by tenne

whole

#### TO THE SEAMEN

whole moneth's experience at Jea, but also by often and diligent observation on land as it may more at large appeare in my booke of errors in Nanigation (which at mine own charges is also published for the common good of you all) wherein the way is shewed how your charts and crossestaves may be freed from the errors aforesaid; and the declinations of the sunne and fixed flarres are set foorth vnto you, agreeably to the trueth of the heavens found out by often and exact observations, whereby the latitudes of places may be found much more truely then bath beene accustomed. This Booke therefore, because it may affoord needfull and for accomplishing the saydrenowmed Count Maurice bis desire in finding the latitude more exactly; and may also deliner you from much inconvenience and daunger, which may necessarily be expected to follow out of so many and notable errors as bisherto have beene in the usuall meanes of Nauigation alreadie mentioned: I commend the same togither with this small Treatise now following unto you all to be dayly tried and examined by the touchstone of your long and skilfull experience at sea: nothing doubting but as they have endured the more exquisite triall of exact observation, and Geometricall de-monstration both by scamen and landmen on shore so they shall be found agreeable to the beedefull experiments of all skilfull Nanigators at sea. And so with my whole heart commending you all to him whose worde both seas 

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# The hauen-finding Art,

Or

# The way to finde any Hauen or place appoynted at sea.

Here is no man, I suppose, that knoweth not with howe great diligence now of a long time (especially since men leaving no part of the world vnattempted, have sayled into America, and to the vtmost Indies) the searchers out of excellent

taught

things have fought some certaine way, whereby they which take charge of ships might know assuredly the situation and longitude of what place soeuer they would goe vnto, and so come to any Haven or place appointed at sea. But I know not how it hath comne to passe, that there could not hitherto any certaine knowledge of that matter be attayned vnto. For some when they indeuoured to find this thing by the magnetical needle gave the Load-stone it selfe a Pole, which of the Load-stone (called also the Magnete) they named the magnetical Pole, or Pole of the Load-stone. But that this is otherwise, the thing it selfe hath

bullenes

taught vs, because the variation of the needle is found not to follow the rule of that Pole. Yet in the meane time this continuall searching gaue occasion of another meane whereby a ship might certainly direct her course vnto any hauen or place at sea whereto you would desire to go, although the true Longitude both of the place wherein the ship is, as also of the place where the hauen is, were both vnknowen. Which that it may in some sont be rudely shewed, and that the circumstances hereof may more clearely be set foorth before your eyes, whereby there may enfue a more certaine and general vie of the same, first of all it must be knowen that wee are taught by dayly experience, that the magnetical needle touched with the Loadstone or Magnete (which therefore we call the magneticall needle) doth not alwayes point out the same part of the world, but without any respect of that magnetical Pole, (whereof we made metion before) sometimes indeed it sheweth the true place of the North: but for the most part it declineth either towards the East or West: which variation, yea even in a small distance of places, hath most manifestly appeared to them which have directed their course from the easterne parts towards the West: For examples sake at Amsterdam the variation is 9 degrees and 30 min. towards the East. In the foreland of England 11 deg. At London I I deg. 30 min. Neare Tinmouth in the fea 12 deg.40 min.and fo forth. and or house to make your way of sequiline eather gravio aims baried from the fallo at Probat

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How any Hauen or place at sea may be found, the latitude and variation of the same place only being knowen.

He variation of the magnetical needle, and the latitude of the placebeing knowen, the same place may be found, although the longitude be vnknown & that dayly experience plentifully teacheth. For (that we may make this matter plain by examples especially) if the mariner know that the latitude of the citie of Amfterdam is 52 deg, and 20 min, and that the variation of the copasse in the same place is 9 deg. & 30 min.he must needs not be ignorant, that when he hath brought himselse to that latitude and variation he is not farre from Amsterdam, what logitude soeuer that citie haue. But some man may object, that there are many places which have the same latitude and variation that the citie of Amsterdam hath: whereto we may readily answere that indeed there be such places: but yet very farre diffant from thence, and such as may easily bee knowen by other circumstances, whereof we shall speake hereafter. And although the mariners may find Amsterdam otherwise, as by the places neere adjoining, by coniectures, by the foundings, by the fands, & many other signes without any regard of the variation: yet I thought good to propound a knowen place for example, that the vniuerfality of the same rule might be knowen in long nauigations, wherein no land appeareth. As for example if the master of a ship desire to fayle from hence to Cape S. Augustine in Brasile, and know that the variatio there (as it is reported) is 3 deg.

stine? Because he speaketh contrary things, when he sayth that the variation there is 3 degrees 10 minutes, and againe auoucheth that it is not.

Neither is this vnworthy the marking, which hath

chure only, affirme that he is neere the Cape S. Augu-

often happened, that he which should have sayled to the Isle of S Helena, when he was come to the latitude of the same Iland, & saw not there the lland, & was also ignorant whether he were to the eastwards or westward fro the same, by consectures sought that place towards the East, which indeed lay fro him towardes the west, & so the surther he sayled the surther alwaies he went from that Iland, Now I leave it to thy consideratio, if he (who soever he were that was master of that ship, which diligently sought that Iland for the space

space of certaine weekes, tacking about also diners times before he could find any place to abide in) if he I say had not bene ignorant what the variation of the compasse was at S. Helens Iland, and what the vse of the variation is at sea, and how to find it out: I seaue it, I say, to thy cosideration, whether he would willingly have stoated doubtfully to and fro following a greater variation, knowing assuredly that the variation there was lesser.

Hereby it may easily be conceived how great viewhere is of the variation, when they especially which in sayling solow the lines shewing the courses (which lines because now they have found this name among the Portugales we cal Rumbs, the ignorance of which (lines) can hardly be permitted in them which attept long voiages vp of the huge ocean) ought every where to know certainly the place of the true North, which is comonly found by the knowledge of the variation.

If any man likewife confider the vncertaine finiation of those places which are set into Globes or sea Charts by the mariners relation, which vncertaintie taketh his beginning from hence, because every man thinketh that to be the true place of the North which is shewed by the Plower de luce (as they call it) of the compasse which they brought with them from home, (which thing also bringeth no lesse doutfulnes to the mariners themselves) hee will thinke (and that not without cause) that the observation of the variation is a very needfull thing even for this cause also: Because it is an easse matter to place the Flower de luce in fuch fore that it shal not mille any thing in shewing the true North part of the world, to wit, if one moue the might

the magneticall needle, or points of the wires in the Compasse from the Flower de luce so much as neede

shall require.

These things therefore having bene observed and granted, and this especially that the variation altereth according to the variety of countries, (as by the common testimony of al men it is proved) it is in some fort manifest that they which denie this varying property to be of very great vie for navigation, are either wises then the common sort, and have some hidden secrets which are not reveiled to every man, or els are notable soolesand mad men.

Therefore when the most excellent Prince Manrice, having throughly considered hereof, thought that it might afforedly be brought to that passe that mariners might receive great profit by this meanes; he (the high Admirall) gave commaundement to all the copanies of the Admiralty (adioining also there to a certaine introduction) that they should doe their best indeuour, that all masters of ships should prouide themselves for this purpose: that is to say, that to what place focuer they should come, they should seeke out the declination of the magneticall needle from the North, or the variation of the Compasse, not lightly, running ourse the matter as it were by the way, and for fashions sake onely; but with great carefulnes and diligence, taking with them meete and needfull instruments for that purpose: and that after their returne into their countrie they should truely and faithfully certifie their companies or brotherhoods of the Admiralty, of that matter: that the felfe same experiments being by them brought into good order, might might be published for the common good.

But that every man may more perfectly learne the circumstances of this matter, I thought it meete here to let downe certaine principles of this thing, which is yet notwithstanding to be further searched into by more experiments, in which shall be shewed a generall view or table of those places, whose variations haue already bene observed by the learned Geographer Petrus Plancius, with continual labour, and not without great charges, from divers corners of the earth neere and farre off: whom for honours fake I therefore name, that as well they that shall hereafter finde out places or hauens after this manner, as also they that have already found, may know that they are bound to give thankes to Planeius alone, as to him that is the chiefe cause of this observation. But that table or generall viewe of variations, whereof there shall hereafter followe a plainer declaration is this.

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A declaration of the former Table or view of variations.

Before we come to the declaration of this Table. this first of al we would not have vnknowen, namely, that if perchance hereafter by more diligent and more exact experience, any other variation, longitude, or latitude of places can be found, then that which is fet downe in this Table, so as it should be needfull to change the definitions and expolitions of somethings and wordes here fet downe: yet we ought not therefore to be scarred from this purpose; but much rather ought we to striue with al our strength to attain thereto, that by litle and litle we may come to a more certaineknowledge of things, building vpon these as vpon foundations: we therefore following this opinion will profecute that as true, which at this time is most like to be true; that if others also doe the same when occasion is given, we may alwaies come neerer to that which is most true in the nature of things.

Which things being omitted, that we may come to the declaration of the former Table, first of all we say, that the first of the three columnes which thou seest in the table, sheweth the variation of the place, the second, the latitude, to which the third is adioyned conteyning the longitudes, as we could by consecture attains vnto them, that the places might so much the more easily be found in the globe, and the manner of the variations might more plainely be shewed in that which solloweth hereafter. The marke of the letter N in the second colume, significth North latitude, and

S South.

Then, because in them mention is made of the varia-

tion, of the Northeasting, of the Northwesting increasing or decreasing, all which (as proper words of Art) have neede of their severall definitions: first of all we must know that the Magnetical needle in one and the same place, doth alwayes shewe the same part of heauen, but not the same part in all places: for in some places it pointeth due North, in other places it declineth more or lesse to the East or West. Therefore in manner of a definition, we will say thus:

# The first definition.

THE declination of the Magneticall needle from the North towardes the East, is called the Northeasting, towards the West, Northwesting, and with a generall name it is called the variation: but the variation and the Northpointing of the needle (that is the pointing of the needle due North) may by a generall name bee called the needle-

pointing, or pointing of the needle.

As concerning those words of increasing and decreasing, as also of the first and second part or space, before we come to the definitions of them, they have neede of some precedent declaration. It may be seene in the Table of variations, that in Corno the Magneticall needle pointeth due North: but after that, the more a man shal goe towards the East, so much the more also shall he see the needle varie towards the East, till he come one mile to the Eastward from Plimonth, where the variation comming to the greatest is 13 degr. 24 min. From hence the Northeasting beginneth to decrease, til you come to Helmshude (which place is Westwards from the North Cape of Finmark) where againe the

the needle pointeth due North. Now the longitude from Corno to Helmshude is 60 degr. Which things being well weighed, it appeareth that the greatest variation 13 degr. 24. minutes at Plimmouth ( the longitude whereof is 30 degr.) is in the midft betweene the places where the needle pointeth due North. For 30 degrees is the midst betweene the beginning and 60 degrees. And what is here faid of the North part, experience teacheth that the same taketh place in the fouth part also, for 105 Spanish miles from Cape S. Augufine at the beginning of longitude, againe it pointeth due North, as it doth 17 Germaine miles from Cape das Aguillas (as it appeareth by the table of variations) which place is in the longitude of 60 degrees, and in the middest betwixt both at 30 degr. (as in the North part) again there is the greatest Northeasting; of which place there was this mention made in the Table or view of variations: towards the Northwest northerly from the Ilands of Tristan da Cuncha, where the variation is 19 degrees.

Out of these we may conclude, that the Magnetical needle doth point due North in every place situate in two meridian halfe-circles drawen from the one pole to the other by Corno and Helmsbude. And that the greatest Northeasting is in all places situate in the meridian semicircle drawen by that place, which we said was distant one mile from Planmouth towards the East. So as that part of the earth which is conteyned betweene two Meridian semicircles, distant each from other 60. degrees in longitude, is the space wherein the Magneticall needle, alwayes declineth from the North towards the East. And the halfe of that part, that is, that portion

portion of the earth which is included betweene two Meridian semicircles, the first of which is drawen by the beginning, the other by the 30 degr. of longitude, is every where the place of the Northeasting increasing; but the other halfe is the place of the Northeasting increasing decreasing, to wit, when one goeth from the West Eastwards, following the order of the degrees of lon-

gitude.

By this that hath beene spoken of the first Segment, with the Northeasting and his parts (in one of which paris the Nonheasting is increasing, in the other decreating )it may easily be understood what the manner of the second Segment is with the Northwesting, and what is the manner of the partes thereof, whereof one is the part of the Northwesting increasing, the other is the part of the Northwesting decreasing, for in the mouth of the river Cantan in China, at the longitude of 160 degrees distant from Corno, the needle pointeth due North the third time: there therfore drawing the third Meridian semicircle, the portion of the earth betweene the foresaid second Meridian semicircle, and this third (distant each from other 100 degrees in longitude) (halbethe space wherein the Magneticall needle declineth from the North towards the West: and in the middle of both in the Meridian semicircle 50 degrees distant from the second, and as much from the third, (or otherwise I to degrees remooued from the first Meridian drawen by Corno) shall be the greatest variation of the Magnetical needle, as it appeareth out of the Table of variations in two places, whereof one is in Williams Iland at Nona Zembla, where the greatest Northwesting is found to be 33 degrees. The D 3 other

other is distant 34 dutch miles to the Southeast from Brandson, where the greatest variation is found to be 22 degrees, and the longitude of each of those places is 110 degrees. So as in the halfe of the second space (which portion of the earth is conteyned betweene the Meridian semicircles of 60 degrees longitude, and of 1 10 degr.) the Northwesting is every where increa-

fing; in the other halfe decreafing.

Of these 160 degrees of Longitude (which arch wanteth but 20 degrees of halfe the compasse of the earth) Plancius hath attained to the knowledge of the variation, in such fort as now we have shewed, As concerning the other parts of the world, distant either towards the West from Corno, or towards the East from Cantan, the experiments which hitherto hee hath gotten from the Spaniards, the Englishmen, & our countriemen (the Netherlanders) doe not well agree. Neither is it any maruell, seeing they had neither perfect knowledge, norneedfull instruments for that purpose: yet he expecteth other experiments from the thips which have now been eabroad 14 moneths and more. In the meane time we will bring forth that to publique view, which a man may without abfurditie imagine.

If so be that the propertie of pointing due North, take place not onely in the three forelaid Semicircles (which we coiecture to be Meridian femicircles drawn from the one pole to the other) but in the whole circlesalfo; there should then be fix such semicircles vpon the earth, conteyning also betweene them six partes

or spaces of the upper face of the earth,

The first with the Northeasting 60 degrees long. The second with the Northwesting 100 degr.long. The The third with the Northeasting 20 degr.long.
The fourth with the Northwesting 60 degr.long.
The fifth with the Northeasting 100 degr.long.
The sixth with the Northwesting 20 degr. long.

That those things which have beene spoken may by certaine geometricall figures be more clearely conceined, let ABCDEFGHIKLM, be the aquinoctiall of the earth: let N be the pole; then let N A bee the halfe of the first Meridian semicircle drawen by Corno: N C, halfe of the second semicircle: N E, of the third: N G, of the fourth: N I, of the fifth: N L, of the sixth. So as the arch A C, may make 60 degrees: C E, 100 degr. and so A E, 160 degr. E G, 20 degr. and so A G, 180 degr. GI, 60 degr. and so A I, 240. I L, 100 degrees, and so A L, 340 degr. L A, 20 degr. and so the whole circle 360 degrees. Then let the sixe pointes B D F H K M be the middles between A C, C E, E G, GI, I L, L A. Which being supposed,

ANC shall fignifie the first space with the Northea-

ANB the Northeasting of the first space increasing.
BNC the Northeasting of the first space decreasing.

CNE the second space with the Northwesting.
CND the Northwesting of the second space increasing.

(sing.

DNE the Northwesting of the second space decrea-ENG the third space with the Northeasting.

ENF the Northeasting of the third space increasing.
FNG the Northeasting of the third space decreasing.

GNI the fourth space with the Northwesting.

GNH the Northwesting of the 4 space increasing. HNI the Northwesting of the 4 space decreasing.

INL

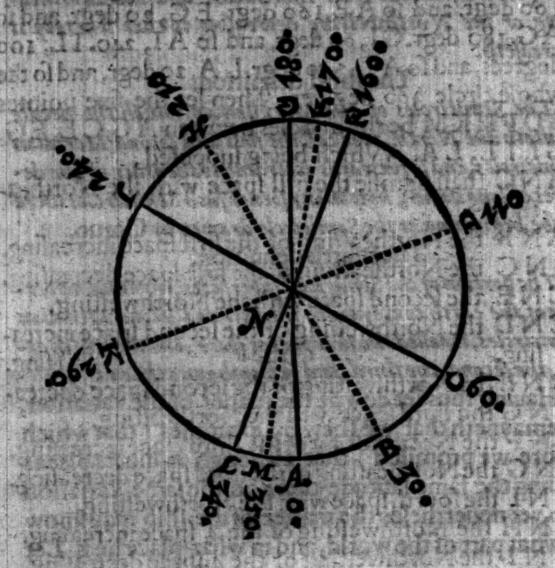
INL the fift space with the Northeasting.

INK the Northeafting of the lift space thereasing. KNL the Northeasting of the fift space decreasing.
LNA the fixt spacewith the Northwesting.

LNM the Northwelling of the 6 space increasing.

MN A the Northwelting of the 6 space decreasing.

Note. Though a man may not without cause stand in doubt that the three last semicircles shall not bee found in the same fort, which the former conjecture hath imagined, but peraduenture in a quantitie eyther greater or lesser, and in another forme: neuerthelesse, here the maner is rudely shewed how the whole world



may be denided into certaine portions by fuch femicircles as shall hereafter bee found by observation Moreover, by that which hath beene spoken, it may eafily be understood what be the Northeastings or northweltings increasing on decreasing, what is the first and second Meridian semicircle, together with the parts or spaces. Which, that we may comprehend in forme of definitions, I thought good in few words thus to pronounce: and we demand of the formation.

The Northeasting or Northmesting increasing is that whereby the variation increaseth, the Magneticall needle being carried from the West Eastwards: and the Northeasting or the Northwesting decreasing is that whereby it decreafeth.

The third definition.

The Semicircles of the Meridian in which the needle pointeth due North, wee call the first and second Meridian Semicircles, and fo forwards according to the order of the degrees of longitude, how many foener fuch Semicircles there Shalbe beginning at the Semicircle drawen by Coruo. The fourth definition below lift but

The portion of the Sphericall superficies, or round upperface of the earth conteyned by the first and second Meridian Semicircles, is called the first part or space, and the rest in order, the second, the third, and so foorth unto the end.

Hauing thus fet downe the maner of the variation, it remayneth that we shew by examples (that which before we promised) that although in divers places having the same latitude there be the same variation also, yet neuertheles the master of the ship may know in what part of the world, and in what place he is. Let

vs therefore againe suppose that a ship had appointed to goe from Amsterdam to Cape S. Augustine, in Brafile, the latitude whereof in the table of variations is fet downe to bee 8 degrees 30 minutes, and the variation northealting increasing of the first space 3 degr. to minutes. The same shippe sayling along by the coast of England, the variation shall be found to northeast or varie towards the East dayly more and more vntill you come to Plimmouth, where it commeth to the greatest, and is 13 deg.24 min. Therefore the ma-Rer of the thip thall know afferedly that hitherto hee hath sayled in the Northeasting of the first space decreating, and that after this he shall have the northeasting increasing, which when he shall find to be ro degrees in the latitude of 38 deg. 55 min. then hee may affure himselfe that hee is come to the Rocke neere Lisbone. Going forwards again from thence as it were towards the Southwell, he shal dayly find the latitude to be diminished, and the magnetical needle declining towards the North. Or otherwise if the magneticall needle recline nottowards the North, but either stand stil, or els decline more towards the East, then he may affure himselfe that hee is carried Eastwards by some secret current not perceived: which notwith. standing he may remedy, if he goe so much the more towards the West, vntill the magneticall needle recouer his due variation. But if hee should come to the northeasting of 3 degrees 10 minutes, before he have his Southerly latitude to be 8 deg. 30 min. he shall then indevour as much as in him lieth to keepe that variation, and so sayle on towards the South part of the world guiding the ship so much the more towards the

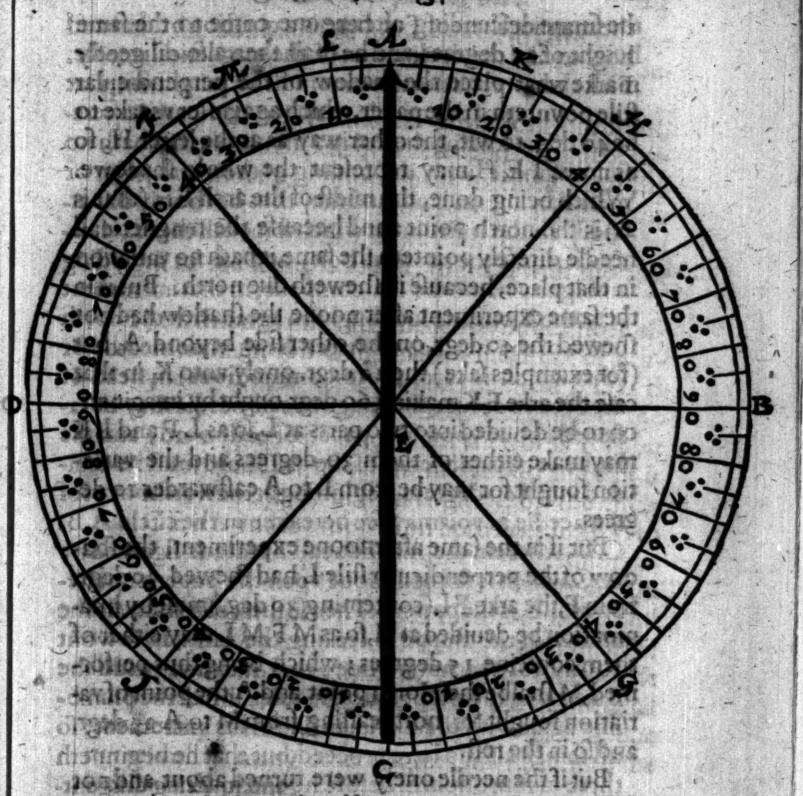
the West on East as roccasion shall require. And although he may deeme otherwife by confecture, yer he That nootobow that conjecture for the reasons before Thewed ton for comming to the fourtherly latitude of 8 degrap min with the northeafting increasing 3 degr so minche may affiredly perforde himselfe that he is necre Cape S. odlugustine, whereas otherwise trusting to conjectures he may very eafily miffe an hundreth leagues of the place to which he had appointed to goe, not knowing in the meane time, whether he be to the castwards, or to the wostwards from thence; which experience it selfe hashalfo taught too much in such nanigations. And therefore the latitude and variation in all places of the eatth being observed, and the knowledge thereof published, thereshall be a much more calle way of fayling about the worlde shen ever hath ded into 360 degrees, beginning ar charotosprad and

Hitherto we have described the kindes of the variation which are afterwards declared out of those things which were set downe in the table of variations. If the mistris of things (experience) shall be reaster teach that any thing is otherwise, that thing may also out of the same experience be otherwise defined, that the massers of ships in their nauigations may follow that only which shall bee best and most profitable.

the same and the North point, and the variation service

A Lthough the finding of the variation, (whereof A hitherto often mentio hath benemade) is known to very many: yet we will in fewe wordes shew this thing to them which as yet peraduenture know not the

the manner thereof For here is a question or demand how to find the declination of the magnetical needle. First therfore the north point must be fought out, that the pointing of the needle may bee compared there with. The finding thereof in a moutable ship hath no small affinitie with the finding of the north point or meridian line on land, and may thus be shouly dispatched. In the Instrument which some call the sea-directoric, formethe nauricall box, and we for anoyding ambiguity mameshe lea-compaffe, in that infletiment I fay the Floure de luce ought to agree with the north point of the needle; or wires lying vuderneath; or (that which is fatre more commodious) in stead of the Floure de luce the inagnetical needle may be fa-fened aboue upon the paper of paltboord, and the limbe or circumference of the paltboord must be dear ded into 360 degrees, beginning at the north poynt of the needle as you may fee hereafter in the circle A.B. C.D. wherein the magneticall needle is lignified by A. C. which is fast ned aboue vpon the paper or pasteboord. Eisthe centers. The viethereofisthis. As the master of the shippe in seeking the lactude is wont totary for the noone tide, that is to fay, witill the shadow of the perpendicular stile promof the plumble line agree with the meridian line in his instrument; for all things also do here proceed, but that he beginneth three or foure homes before noone, marking diligently into which degree of the compasse, or into what diuition the thadow of the perpedicular stile, or plumbline falleth Let vs suppose therefore that he find it in the 40 deg, which we have noted with the letter P. fo as G.E.F. may fignific the whole shadow then hee Mall dic



That leeke the height of the lunne, which for examples take admit hee find to bee 25 degrees: which together with the 40 degrees about named, he shall note down for helping his memory: After this he shall attend till E. 2. the

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the sunne descending after noone come to the same height of 25 degrees, and he shall then also diligently marke what place the shadow of the perpendicular stile poynteth in the paper, which agains let vs take to be 40 deg. to wit, the other way as at the levet H, fo as nowe IEH may represent the whole shadowe. Which being done, the midst of the arch FH (that is A) is the north point: and because the magnetical needle directly pointern the same, is hath no variation in that place, because it sheweth due north. But if in the same experiment after noone the shadow had not shewed the 40 degs, on the other side beyond A, but (for examples sake) the 20 degr. onely vnto K, in that case the arke F K making 60 degr ought by imaginati on to be devided into two parts at L, fo as LF and LK: may make either of them 30 degrees and the variation fought for may be from Lto A castwardes to degrees.

But if in the same afternoone experiment, the shadow of the perpendicular stile L had shewed 30 degr. from F, the arke F L (conteining 30 deg.) must by imagination be deuided at M, so as M F, M L may either of them conteine 15 degrees; which being thus performed, M shalbe the North point, and A the point of variation sought for, northeasting from M to A 25 degr.

and so in the rest.

But if the needle onely were turned about and not fastned to the paper or pastborde (as before) and the degrees were marked in the margine or limbe of the box, or case of the instrument as is sometimes yied, there is the same manner of ving it, that was before rehearsed: sauing that in the beginning of the observation,

tion, the box must bee turned about so farre till the Magneticall needle shewe the beginning of the degrees.

Others take an Azimuthal or verticall quadrant, whose Horizontall plaine (whereupon it standeth vparight) without any impediment received from the motion of the ship alwayes remayneth parallell to the Horizon in such manner as we shall shew. Thus the height of the sunne is found, togither with the azimuth.

The fashion of this instrument may be described after this manner, AB C signifieth a quadrant of a circlestanding at right angles. Vpon the circle BDCE denided into 360 degrees, whereby the plaine of the Horizon is fignified. The center thereof is F vpon which the quadrant may be turned about; and that it may alwayes remaine at right angles upon the circle BD CE it is vnder-propped on both sides from Gto Dand E, and those props are fastned to the same quadrant, that they may be turned about togither with it. Moreover in the circle BDCE there is a glasse, and vnderthe glasse a magneticall needle, which must be folong as the box may fuffer it. And the box or case hath within it 360, degrees, which the magneticall needle may precifely poynt vnto, which likewife doe agree with as many other degrees inscribed into the horizontall plaine.

This instrument was made according to the inuention of Reginaldus Petraus, hanging upon two axtrees like the sea-compasse that so the circle BDCE notwithstanding the motion of the ship may alwayes bee equally distant from the Horizon. And that this may

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be done with the greater fecuritie, the weight marked with the letter H is adioyned vnderneath, conteyning 25.or 30. pounds, or so many as the greatnesse of the instrument shall require. But this also is worthy to benoted to wit, that the quadrant perpendicularly erect in his place is of the same weight on both sides of the center: that is to fay, the fide from F to C counterpoyseth the side from F to B which may be knowen if a man taking vp the quadrant, hang it with G downewards, the threed being fastned in the middest of BC at F and then cut off fo much of the heavier part, as may suffice, that the line BC may hang levell, But because some man may object that the ruler or index which the Barbarians call the Albidada, may bring a great varietie in the weight as it shall be turned higher or lower : wee must know that any such thing need not to bee greatly feared, because of the great weight H and the lightnesse of the ruler.

The vie of this instrument in sinding the North point and variation is this: you must begin to observe (as in the former kind) certaine houres before noone, and the instrument must be turned vntill the magneticall needle point to the beginning of the circle: then the quadrant must be turned this way or that way, and the sight-ruler of the quadrant must be listed vp, or put downe till the sunne shine through the sight. All which being done, suppose it bee found (for examples sake) that the vtmost margine or index of the quadrant shew in the Horizontal plaine 40, degreas and admit the height of the sunne be also found to be 25 degrees, which togither with the 40, degrees he shall for memorie sake have need to note. And when he hath expected after

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mone till the sunne descending by the same instrument be sound placed in the same 25 degr of alritude,
then the box it selse must againe beturned this way or
that way, vntill (the sunne againe shining through the
sights) the magnetical needle doe point to the beginning of the circle. Which things being thus disparched, the middle point of the arch in the horizontall
plaine betweene the first and second experiment is the
North point, and how much the needle declineth
from that point, so much is the variation sought for,
as before wee have shewed in the first example more
at large of many way.

Whatfocuer we have affirmed to be availeable in the day time, in these experiments of the sunne, the same may bee understood and done in like manner in the night, by any of the fixed starres, whereof there is the same vie in this matter that there is of the funne. Butthere is not the same reason of the moone, aswell because of the swiftnesse of her proper motion; as also because of the greatnesse of her parallax (as they call it) which the overmuch necessesses of the moone to theglobe of the earth bringeth forth. But this also is to be noted that two, three, or foure, yea and more ob feruations may be made in the fore-noone. As for example let the first bee when the sunne is to degrees aboue the horizon, the second when it is 15. degr. the third when it is 20. degr, and if any man will make triall as often after noone, hee shall see how every experiment agreeth with other and when at every moment the same North point is found, that thing shall give the master of the ship no small courage, and more certaine confidence of his worke bn A \_ 210 n or bean sund

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But notwithstanding, when the mariner sayleth from the East Westwards, or contrariwise from the West Eastwards, it may be that in the space of 10 or 12 houres between the first and second experiment, there may be difference of one degree or more in the variation, whereof may follow that the North poynt found by the first forenoone observation, and the last in the afternoone, shall not agree with that which was found by the first in the afternoone and the last in the forenoone: when notwithstanding the mariner hath not erred in obseruing.
Which if it shall happen often, the skilfull mariner

may judge thereby what difference of variation is answerable to any determinate time of fayling, and so finde a way whereby the North poynt may bee found with more certaintie and securitie: which thing may thus also be done, if

a man diligently compare the ls as more variation found in the forline with the mer dayes with the of shoom of variation which

he prefently datain bas feeth.

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